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Split and two-zone elastic-plastic shock waves in nickel: a molecular dynamics study BRIAN DEMASKE, VASILY ZHAKHOVSKY, University of South Florida, NAIL INOGAMOV, Landau Institute for Theoretical Physics, CARTER WHITE, Naval Research Laboratory, IVAN OLEYNIK, University of South Florida — Shock waves in <110>and <111>directions of single-crystal nickel samples were studied by molecular dynamics (MD) simulations. Standard piston-driven simulations were performed to investigate the split-wave regime, including an elastic precursor followed by a plastic wave both moving with different velocities. At moderate piston velocities, the material is initially in a metastable over-compressed elastic state. It later collapses into a plastic state resulting in a two-wave structure consisting of a slow plastic wave and fast elastic precursor. A single two-zone elastic-plastic shock-wave regime, appearing at higher piston velocities, was studied by a moving window MD technique. The plastic wave attains the same speed as the elastic precursor to form a single two-zone wave – the simulated elastic zone width extending to hundreds nanometers. The orientation dependence of the shock-wave phenomena are also discussed.

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